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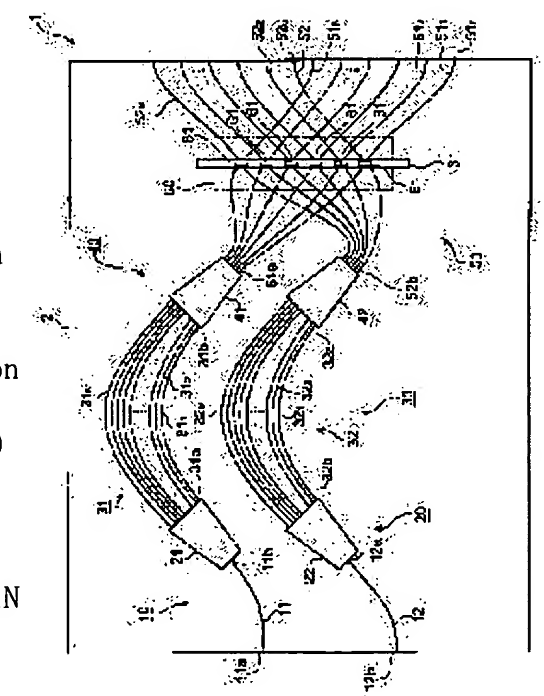
(54) OPTICAL ADM DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an optical ADM device which is capable of suppressing that the device becomes large.
SOLUTION: In the optical ADM device, a first channel waveguide section 10, a first slab waveguide section 20, an array waveguide section 30, a second slab waveguide section 40 and a second channel waveguide section 50 for wavelength separation and synthesis are formed on a substrate 2. And also, a switch section 60 is disposed on a substrate 2. The switch section 60 has movable mirrors 61. The movable mirrors 61 are freely movable in an advance direction and retreat direction with respect to the optical paths in the second channel waveguides 511 to 51N for wavelength separation and second channel waveguides 521 to 52N for wavelength synthesis.



The movable mirrors 61 is disposed on the substrate 2 in such a manner that the movable mirrors 61 are made freely movable in the advance direction and retreat direction with respect to groove parts 3 of the positions corresponding to respective intersection parts.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to optical ADM (Add Drop Multiplexer) equipment.
[0002]
[Description of the Prior Art] As this kind of optical ADM equipment, optical ADM equipment which was indicated by JP,11-271559,A is known. The optical ADM equipment indicated by this JP,11-271559,A The optical demultiplexer connected to input port waveguide and input port waveguide on a substrate, The optical multiplexer which has input port connected to the output port of an optical demultiplexer by waveguide, The waveguide which is equipped with the output port waveguide connected to an optical multiplexer, and connects the output port of an optical demultiplexer and the input port of an optical multiplexer The ad (add) of the signal light to an optical transfer way or the optical multi port optical switch which performs those both sides or it drops (drop) is included.
[0003] The heat optical switch of the gestalt of a Mach TSUENDA (MZ) interferometer is used for this optical switch. The heat optical switch has the heating element and this heating element controls the optical path length (phase shift) of optical waveguide. For example, in the optical ADM equipment indicated by JP,11-271559,A, while a heat optical switch drops the signal light from an optical demultiplexer by impressing an electrical potential difference to a heating element, it carries out the ad of the different signal light, and outputs it to an optical multiplexer. On the other hand, a heat optical switch outputs the signal light from an optical demultiplexer to an optical multiplexer by canceling impression of the electrical potential difference to a heating element.
[0004]
[Problem(s) to be Solved by the Invention] However, it became clear that it had the trouble that the optical path length suitable in order for optical ADM equipment using the heat optical switch of the gestalt of MZ interferometer as an optical switch to form an interference device is needed, the area which an optical switch occupies becomes large, the area of a substrate becomes large, and the optical whole ADM equipment is enlarged, like the optical ADM equipment indicated by JP,11-271559,A.
[0005] Moreover, since the optical ADM equipment using a heat optical switch used the modulation of the refractive index by the temperature change (heating by the

heating element), it also became clear that it had the trouble that the working speed as an optical switch becomes slow (10ms or more).
[0006] Furthermore, with the optical ADM equipment using a heat optical switch, since a delicate change of a refractive index was controlled by magnitude of the electrical potential difference impressed to a heating element, the adjustment for making the change property of each optical switch into homogeneity was needed, and it also became clear that it had the trouble that productivity gets worse.
[0007] This invention was made in view of the above-mentioned point, and this invention makes it a technical problem to offer the optical ADM equipment which can control enlargement of equipment.
[0008]
[Means for Solving the Problem] The optical ADM equipment concerning this invention is optical ADM equipment equipped with the wavelength separation composition section and the switch section on a substrate, and the wavelength separation composition section is characterized by for the switch section to have the movable mirror which can move in the advance direction and the recession direction freely to the optical path by the side of wavelength separation of the wavelength separation composition section including at least one array waveguide mold diffraction grating.
[0009] With the optical ADM equipment concerning this invention, a movable mirror reflects the signal light which passes along the optical path by the side of wavelength separation by the condition of having marched out to the optical path by the side of wavelength separation of the wavelength separation composition section, and the switch section passes the signal light in which a movable mirror passes along the optical path by the side of wavelength separation by the condition left to the optical path by the side of wavelength separation. The switch section becomes the thing of a mechanical configuration by this, and the area of a substrate becomes small as compared with the conventional optical ADM equipment using a heat optical switch. Consequently, enlargement of equipment can be controlled.
[0010] Moreover, the switch section has two or more movable mirrors, and, as for two or more movable mirrors, it is desirable to be installed in the shape of a straight line along the slot which crosses the optical path by the side of wavelength separation of the wavelength separation composition section. Thus, when constituted, simple and the configuration which can be arranged in low cost can be realized for the switch section. Moreover, the precision prescribe over the arrangement location of a movable mirror is eased, attachment by the substrate of the switch section becomes easy, and productivity can be improved.
[0011] The wavelength separation composition section contains the array waveguide mold diffraction grating for wavelength separation, and the array waveguide mold diffraction grating for wavelength composition. Moreover, the array waveguide mold diffraction grating for wavelength separation The 1st channel waveguide for wavelength separation, the 1st slab waveguide for wavelength separation, It has the array waveguide for wavelength separation, the 2nd slab waveguide for wavelength separation, and the 2nd two or more channel waveguides for wavelength separation. The array waveguide mold diffraction grating for wavelength composition The 1st channel waveguide for wavelength composition, the 1st slab waveguide for wavelength composition, It has the array waveguide for wavelength

composition, the 2nd slab waveguide for wavelength composition, and the 2nd two or more channel waveguides for wavelength composition. The waveguides along which the signal light of the same wavelength of the 2nd channel waveguide for wavelength separation and the 2nd channel waveguide for wavelength composition passes cross on one straight line, a slot is formed along with a straight line, and, as for the switch section, it is desirable to have the crossing movable mirror of the number of points and the same number. Thus, when constituted, in the optical ADM equipment of a configuration of having had the array waveguide mold diffraction grating for wavelength separation (it abbreviating to AWG below Arrayed-Waveguide Grating:) and AWG for wavelength composition, simple and the configuration which can be arranged in low cost can be realized for the switch section. Moreover, the precision prescribe over the arrangement location of a movable mirror is eased, attachment by the substrate of the switch section becomes easy, and productivity can be improved.

[0012] The wavelength separation composition section contains the array waveguide mold diffraction grating for wavelength separation composition. Moreover, the array waveguide mold diffraction grating for wavelength separation composition The 1st channel waveguide for wavelength separation composition, the 1st slab waveguide for wavelength separation composition, It has the array waveguide for wavelength separation composition, the 2nd slab waveguide for wavelength separation composition, and the 2nd two or more channel waveguides for wavelength separation composition. A slot between the 2nd slab waveguide for wavelength separation composition, and the 2nd channel waveguide for wavelength separation composition -- every -- it is formed in the direction in which the 2nd channel waveguide for wavelength separation composition was installed side by side, and, as for the switch section, it is desirable to have the movable mirror of the 2nd channel waveguide for wavelength separation composition and the same number. Thus, when constituted, in the optical ADM equipment of a configuration of that AWG for wavelength separation and AWG for wavelength composition were communalized, simple and the configuration which can be arranged in low cost can be realized for the switch section. Moreover, the precision prescribe over the arrangement location of a movable mirror is eased, attachment by the substrate of the switch section becomes easy, and productivity can be improved. Furthermore, the transparency band of the optical ADM equipment which has a flat property substantially is realizable.

[0013] The wavelength separation composition section contains the array waveguide mold diffraction grating for wavelength separation, and the array waveguide mold diffraction grating for wavelength composition. Moreover, the array waveguide mold diffraction grating for wavelength separation The 1st channel waveguide for wavelength separation, the 1st slab waveguide for wavelength separation, It has the array waveguide for wavelength separation, the 2nd slab waveguide for wavelength separation, and the 2nd two or more channel waveguides for wavelength separation composition. The array waveguide mold diffraction grating for wavelength composition The 1st channel waveguide for wavelength composition, the 1st slab waveguide for wavelength composition, The array waveguide for wavelength composition, the 2nd slab waveguide for wavelength composition which shares a part with the 2nd slab waveguide for wavelength separation continuously, It has the 2nd two or more channel waveguides for wavelength separation composition. And a slot

It is formed in the direction in which the 2nd channel waveguide for wavelength separation composition was installed side by side. between the 2nd slab waveguide for wavelength separation and the 2nd slab waveguide for wavelength composition, and the 2nd channel waveguide for wavelength separation composition -- every -- As for the switch section, it is desirable to have the movable mirror of the 2nd channel waveguide for wavelength separation composition and the same number. Thus, when constituted, in AWG for wavelength separation, and AWG for wavelength composition, simple and the configuration which can be arranged in low cost can be realized for the switch section in the optical ADM equipment of a configuration of that the 2nd slab waveguide for wavelength separation and the 2nd slab waveguide for wavelength composition share a part. Moreover, the precision prescribe over the arrangement location of a movable mirror is eased, attachment by the substrate of the switch section becomes easy, and productivity can be improved. Moreover, the transparency band of the optical ADM equipment which has a flat property substantially is realizable. Furthermore, compared with the optical ADM equipment of a configuration of that AWG for wavelength separation and AWG for wavelength composition were communalized, it becomes possible to reduce the number of optical circulators.

[0014] Moreover, the insulating layer by which, as for the switch section, a movable mirror is prepared in one field side, It has further the 1st electrode layer formed in the field side of another side of an insulating layer, and the 2nd electrode layer formed in the location which counters the insulating layer of a substrate. An insulating layer It is desirable to bend with the electrostatic attraction generated by impressing a predetermined electrical potential difference between the 1st electrode layer and the 2nd electrode layer, and to move a movable mirror in the advance direction or the recession direction to the optical path by the side of wavelength separation. Thus, when constituted, as compared with the conventional optical ADM equipment which used the heat optical switch, the working speed of the switch section can be made quick.

[0015] Moreover, while not impressing the predetermined electrical potential difference between the 1st electrode layer and the 2nd electrode layer, it is desirable [an insulating layer] to bend beforehand and to be formed so that a movable mirror may be in the condition of having left to the optical path by the side of wavelength separation. Thus, when constituted, the power consumption for being able to set up the condition that the movable mirror left to the optical path by the side of wavelength separation of the wavelength separation composition section, as an initial state, and operating the switch section which is not impressing the predetermined electrical potential difference between the 1st electrode layer and the 2nd electrode layer can be reduced.

[0016] Moreover, the 1st electrode layer by which, as for the switch section, a movable mirror is prepared in one field side, It has further the 2nd electrode layer formed in the location which counters the 1st electrode layer on both sides of an insulating layer. The 1st electrode layer It is desirable to bend with the electrostatic attraction generated by impressing a predetermined electrical potential difference between the 1st electrode layer and the 2nd electrode layer, and to move a movable mirror in the advance direction or the recession direction to the optical path by the side of wavelength separation. Thus, when constituted, as compared with the conventional optical ADM equipment which used the heat

optical switch, the working speed of the switch section can be made quick. Moreover, since a movable mirror is prepared in the 1st electrode layer as compared with the thing of a configuration of forming the 1st electrode layer in one field side of the insulating layer in which a movable mirror is prepared, it becomes possible to attain the process simplification and low-cost-izing at the time of manufacturing the switch section.

[0017] Moreover, while not impressing the predetermined electrical potential difference between the 1st electrode layer and the 2nd electrode layer, it is desirable [the 1st electrode layer] to bend beforehand and to be formed so that a movable mirror may be in the condition of having left to the optical path by the side of wavelength separation. Thus, when constituted, the power consumption for being able to set up the condition that the movable mirror left to the optical path by the side of wavelength separation of the wavelength separation composition section, as an initial state, and operating the switch section which is not impressing the predetermined electrical potential difference between the 1st electrode layer and the 2nd electrode layer can be reduced.

[0018] Moreover, as for the 1st electrode layer, it is desirable to be formed with the same ingredient as a movable mirror. Thus, when constituted, the 1st electrode layer and movable mirror can be formed in the switch section very easily.

[0019] Moreover, as for a movable mirror and the 1st electrode layer, being formed with nickel is desirable. Thus, when constituted, equipment can form a movable mirror and the 1st electrode layer simply [a process] using a cheap metal plating technique.

[0020]

[Embodiment of the Invention] Hereafter, the suitable operation gestalt of the optical ADM equipment by this invention is explained to a detail, referring to a drawing. In addition, in each drawing, the same sign is given to the same element, and the overlapping explanation is omitted.

[0021] (The 1st operation gestalt) Based on drawing 1 , the optical ADM equipment concerning the 1st operation gestalt of this invention is explained first. Drawing 1 is the block diagram showing the optical ADM equipment concerning the 1st operation gestalt.

[0022] The optical ADM equipment 1 concerning the 1st operation gestalt is considered as the configuration equipped with the waveguide mold diffraction grating (AWG) for wavelength separation, and AWG for wavelength composition, and each AWG is formed on the substrate 2 which consists of Si or SiO2. Moreover, the switch section 60 is arranged on the substrate 2.

[0023] The 1st channel waveguide section 10 contains the 1st one channel waveguide 11 for wavelength separation, and the 1st one channel waveguide 12 for wavelength composition. The 1st slab waveguide section 20 contains the 1st slab waveguide 21 for wavelength separation connected to the 1st channel waveguide 11 for wavelength separation, and the 1st slab waveguide 22 for wavelength composition connected to the 1st channel waveguide 12 for wavelength composition.

[0024] The array waveguide section 30 contains the array waveguide section 31 for wavelength separation which consists of channel waveguides 311-31M of M (M>=2) book with which it connects with the 1st slab waveguide 21 for wavelength separation, and each optical path lengths differ mutually, and the array waveguide section 32 for wavelength composition which consists of channel waveguides 321-32M

of M (M>=2) book with which it connects with the 1st slab waveguide 22 for wavelength composition, and each optical path lengths differ mutually. The 2nd slab waveguide section 40 contains the 2nd slab waveguide 41 for wavelength separation connected to the array waveguide section 31 for wavelength separation, and the 2nd slab waveguide 42 for wavelength composition connected to the array waveguide section 32 for wavelength composition. The 2nd channel waveguide section 50 for wavelength separation composition contains the 2nd channel waveguide 511-51N for wavelength separation of N (N>=2) book connected to the 2nd slab waveguide 41 for wavelength separation, and the 2nd channel waveguide 521-52N for wavelength composition of N (N>=2) book connected to the 2nd slab waveguide 42 for wavelength composition.

[0025] In optical ADM equipment 1, AWG for wavelength separation will have the 1st channel waveguide 11 for wavelength separation, the 1st slab waveguide 21 for wavelength separation, the array waveguide section 31 for wavelength separation, the 2nd slab waveguide 41 for wavelength separation, and the 2nd channel waveguide 511-51N for wavelength separation. On the other hand, in optical ADM equipment 1, AWG for wavelength composition will have the 1st channel waveguide 12 for wavelength composition, the 1st slab waveguide 22 for wavelength composition, the array waveguide section 32 for wavelength composition, the 2nd slab waveguide 42 for wavelength composition, and the 2nd channel waveguide 521-52N for wavelength composition.

[0026] The 1st channel waveguide 11 for wavelength separation has input edge 11a in the end face of a substrate 2, and has outgoing end 11b which outputs the signal light inputted into this input edge 11a in a junction location with the 1st slab waveguide 21 for wavelength separation. The 1st channel waveguide 12 for wavelength composition has input edge 12a in a junction location with the 1st slab waveguide 22 for wavelength composition, and has outgoing end 12b which outputs the signal light inputted into this input edge 12a in the end face of a substrate 2.

[0027] The 1st slab waveguide 21 for wavelength separation makes the signal light inputted into the 1st slab waveguide 21 for wavelength separation from outgoing end 11b of the 1st channel waveguide 11 for wavelength separation input into input edge 31a of the array waveguide section 31 for wavelength separation joined to this 1st slab waveguide 21 for wavelength separation. The 1st slab waveguide 22 for wavelength composition makes the signal light inputted into the 1st slab waveguide 22 for wavelength composition from outgoing end 32b of the array waveguide section 32 for wavelength composition joined to this 1st slab waveguide 22 for wavelength composition input into input edge 12a of the 1st channel waveguide 12 for wavelength composition.

[0028] The array waveguide section 31 for wavelength separation has input edge 31a which inputs signal light from the 1st slab waveguide 21 for wavelength separation, and outgoing end 31b which outputs the signal light to the 2nd slab waveguide 41 for wavelength separation. each optical path lengths differ predetermined length deltaL every, and the channel waveguides 311-31M of M book give phase contrast to the signal light which guides each.

[0029] The array waveguide section 32 for wavelength composition has input edge 32a which inputs signal light from the 2nd slab waveguide 42 for wavelength composition, and outgoing end 32b which outputs the signal light to the 1st slab

waveguide 22 for wavelength composition. each optical path lengths differ predetermined length deltaL every, and the channel waveguides 321-32M of M book give phase contrast to the signal light which guides each.
[0030] The 2nd slab waveguide 41 for wavelength separation makes the signal light inputted into the 2nd slab waveguide 41 for wavelength separation from outgoing end 31b of the array waveguide section 31 for wavelength separation input into channel waveguide [which is joined to this 2nd slab waveguide 41 for wavelength separation / 2nd / for wavelength separation / 511-51N] input edge 51a. The 2nd slab waveguide 42 for wavelength composition makes the signal light inputted into the 2nd slab waveguide 42 for wavelength composition from channel waveguide [which is joined to this 2nd slab waveguide 42 for wavelength composition / 2nd / for wavelength composition / 521-52N] outgoing end 52b input into input edge 32a of the array waveguide section 32 for wavelength composition.
[0031] Each outputs signal light inputted into input edge 51a from the 2nd slab waveguide 41 for wavelength separation to outgoing end 52b in which it was prepared by the end face of a substrate 2 511-51Ns of 2nd channel waveguide for wavelength separation (drop). Each outputs the signal light inputted from input edge 52a prepared in the end face of a substrate 2 (ad) from outgoing end 52b to the 2nd slab waveguide 42 for wavelength composition 521-52Ns of 2nd channel waveguide for wavelength composition. The 2nd channel waveguide 511-51N for wavelength separation and the 2nd channel waveguide 521-52N for wavelength composition are formed so that it may cross in the part of a slot 3 which corresponding waveguides explain below (for example, rectangular cross).
[0032] It extends in the direction in which the 2nd channel waveguide 511-51N for wavelength separation and the 2nd channel waveguide 521-52N for wavelength composition were installed side by side, and the slot 3 which cuts each the 2nd channel waveguide 511-51N for wavelength separation and channel waveguide [2nd / for wavelength composition / 521-52N] intersection is formed in the substrate 2. A slot 3 is formed by using a dicing technique etc.
[0033] The switch section 60 has the movable mirror 61, an insulating layer 62, and the 1st electrode layer 63 and the 2nd electrode layer 64, as shown also in drawing 2 - drawing 4 . The intersection (the 2nd channel waveguide 511-51N for wavelength separation or 2nd channel waveguide 521-52N for wavelength composition) and the movable mirror 61 of the same number are arranged in the switch section 60 in the shape of an array, and each movable mirror 61 is installed in the shape of a straight line so that a slot 3 may be met. The movable mirror 61 is freely movable in the advance direction and the recession direction to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and the 2nd channel waveguide 521-52N for wavelength composition, and the switch section 60 is arranged on the substrate 2 so that the migration of each movable mirror 61 in the advance direction and the recession direction may be attained to the slot 3 of the location corresponding to each intersection. The movable mirror 61 is presenting the monotonous configuration with about [200micrometerx100micrometer] magnitude in this operation gestalt.
[0034] An insulating layer 62 consists for example, of polish recon, and the movable mirror 61 is formed in the field side of one of these. The 1st electrode layer 63 is formed in the field side of another side of an insulating layer 62. The 2nd electrode layer 64 is formed in the location which counters one field of

the insulating layer 62 of a substrate 2. An insulating layer 62 bends with the electrostatic attraction generated by impressing a predetermined electrical potential difference between the 1st electrode layer 63 and the 2nd electrode layer 64, and as shown in drawing 4 and drawing 5 , it moves the movable mirror 61 in the advance direction or the recession direction to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection. In this operation gestalt, width of face is set to about 200 micrometers, die length is set to about 1.5mm, and, as for the insulating layer 62, thickness is set to about 1.5 micrometers. Moreover, thickness of the 1st electrode layer 63 and the 2nd electrode layer 64 is set to about 50nm.

[0035] Moreover, while not impressing the predetermined electrical potential difference between the 1st electrode layer 63 and the 2nd electrode layer 64, it bends beforehand and the insulating layer 62 is formed so that the movable mirror 61 may be in the condition of having left to each waveguides 511-51N of the 2nd channel waveguide section 50 for wavelength separation composition, and the optical path in 521-52N. This is not impressing the predetermined electrical potential difference between the 1st electrode layer 63 and the 2nd electrode layer 64. The condition that the movable mirror 61 left to the optical path in the 2nd channel waveguide 511-51N for wavelength separation and channel waveguide [2nd / for wavelength composition / 521-52N] intersection can be set up as an initial state. The power consumption for operating the switch section 60 (movable mirror 61) can be reduced. In addition, in this operation gestalt, an insulating layer 62 will be in the condition of having bent beforehand, by forming the 1st electrode layer 63 so that compressive stress may occur in the 1st electrode layer 63.

[0036] Next, the production process of the switch section 60 is explained based on drawing 6 . The switch section 60 is manufactured by using thin film technologies, such as a photolithography technique and an etching technique. In addition, in drawing 6 , although the example which forms one movable mirror 61 and the 1st one electrode layer 63 to one insulating layer 62 is shown, it can manufacture similarly about what arranged two or more movable mirrors 61 in the shape of an array.

[0037] First, as shown in drawing 6 (a), a photolithography technique etc. is used on the Si substrate 71, and the metal pattern 72 corresponding to the 1st electrode layer 63 is formed. At this time, the metal pattern 72 (1st electrode layer 63) is formed, controlling stress so that compressive stress occurs to the metal pattern 72 (1st electrode layer 63). Formation of the metal pattern 72 forms the polish recon film 73 using CVD or a sputtering technique, as shown in drawing 6 (b). Furthermore, the resist film 74 is applied on the polish recon film 73.

[0038] Spreading of the resist film 74 fabricates the mold 75 of the part which is equivalent to the resist film 74 at the movable mirror 61 using a lithography technique etc., as shown in drawing 6 (c). Then, as shown in drawing 6 (d), the metals (for example, copper or nickel etc.) 76 which serve as the movable mirror 61 in the mold 75 formed in the resist film 74 with a metal plating technique are grown up. Finally, as shown in drawing 6 (e), the Si substrate 71 and the resist film 74 are removed using an etching technique. thus, the thing for which thin film technologies, such as a photolithography technique and an etching technique,

are used -- the switch section 60 -- low cost -- and it can manufacture easily.
[0039] An electrical potential difference predetermined to between the 1st electrode layer 63 and the 2nd electrode layer 64 (in this operation gestalt) When about 20V is impressed, as shown in drawing 4 , an insulating layer bends with the electrostatic attraction generated between the 1st electrode layer 63 and the 2nd electrode layer 64. The movable mirror 61 will be in the condition that the movable mirror 61 marched out to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection. In the condition that the movable mirror 61 marched out to the optical path [in / in movable mirror 61 / the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide / 2nd / for wavelength composition / 521-52N / intersection] The movable mirror 61 reflects the signal light which was outputted from the 2nd slab waveguide 41 for wavelength separation, and has passed along the 2nd channel waveguide 511-51N for wavelength separation, and is made to input it into the 2nd corresponding channel waveguide 521-52N for wavelength composition.
[0040] When not impressing a predetermined electrical potential difference between the 1st electrode layer 63 and the 2nd electrode layer 64, as shown in drawing 5 , the movable mirror 61 will be in the condition of having left to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection. In the condition that the movable mirror 61 left to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection The signal light which was outputted from the 2nd slab waveguide 41 for wavelength separation, and has passed along the 2nd channel waveguide 511-51N for wavelength separation will pass along the space in a slot 3, and will be resulted and dropped with channel waveguide [2nd / for wavelength separation / 511-51N] outgoing end 51b. Moreover, when the signal light by which the ad was carried out from channel waveguide [2nd / for wavelength composition / 521-52N] input edge 52a is inputted, the signal light by which the ad was carried out passes along the space in a slot 3, and results in channel waveguide [2nd / for wavelength composition / 521-52N] outgoing end 52b. In addition, loss of the signal light in a slot 3 can be controlled to about 3dB by setting the width of face of a slot 3 as about 20 micrometers. Furthermore, if it is filled up with the matching oil of electric insulation and it is operated to a slot 3, loss will be possible for 1dB or less, and loss will be possible for 0.3dB by improving association with the reflected light and the 2nd channel waveguide 511-51N for wavelength separation by making the movable mirror 61 into a concave surface.
[0041] Therefore, in optical ADM equipment 1, while dropping the signal light of a certain wavelength inputted into the 1st channel waveguide section 10 by carrying out selection actuation of the predetermined movable mirror 61 in the switch section 60 of a configuration of having mentioned above, with the signal light of other wavelength which was not dropped, the ad of the signal light of a certain wavelength can be carried out, and it can output from the 1st channel waveguide section 10.
[0042] thus, with the optical ADM equipment 1 concerning a **** 1 operation gestalt Since it considers as the thing of the mechanical configuration that the

switch section 60 has the movable mirror 61 which can move in the advance direction and the recession direction freely to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection As compared with the conventional optical ADM equipment using a heat optical switch, the area of a substrate 2 becomes small. Consequently, enlargement of optical ADM equipment 1 can be controlled.

[0043] Moreover, in the optical ADM equipment 1 of a configuration of having had AWG for wavelength separation and AWG for wavelength composition, simple and the configuration which can be arranged in low cost are [the switch section 60] realizable.

[0044] The movable mirror 61 is that the movable mirror 61 can reflect certainly the signal light from the 2nd channel waveguide 511-51N for wavelength separation in 521-52 Ns of 2nd channel waveguide for wavelength composition, even if the arrangement location of the movable mirror 61 (switch section 60) shifts in the direction parallel to the mirror side (reflector) of the movable mirror 61 somewhat, since the monotonous configuration is presented. Moreover, signal light becomes possible [reflect the signal light from the 2nd channel waveguide 511-51N for wavelength separation 521-52Ns of 2nd channel waveguide for wavelength composition, where the reflectivity of a certain extent is secure], even if the arrangement location of the movable mirror 61 (switch section 60) shifted in the direction perpendicular to the mirror side (reflector) of the movable mirror 61 somewhat, since it had predetermined flux of light width of face. From these things, the precision prescribe over the arrangement location of the movable mirror 61 is eased, attachment by the substrate 2 of the switch section 60 becomes easy, and productivity can be improved.

[0045] The switch section 60 Moreover, the movable mirror 61, an insulating layer 62, and the 1st electrode layer 63, Have the 2nd electrode layer 64 and it bends with the electrostatic attraction generated when an insulating layer impresses a predetermined electrical potential difference between the 1st electrode layer 63 and the 2nd electrode layer 64. By moving the movable mirror 61 in the advance direction or the recession direction to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection The working speed of the switch section 60 is set to 1 or less ms, and can make the working speed of the switch section 60 quick as compared with the conventional optical ADM equipment using a heat optical switch.

[0046] (The 2nd operation gestalt) Next, based on drawing 7 , the optical ADM equipment concerning the 2nd operation gestalt of this invention is explained. Drawing 7 is the block diagram showing the optical ADM equipment concerning the 2nd operation gestalt.

[0047] The optical ADM equipment 101 concerning the 2nd operation gestalt is considered as the configuration by which AWG for wavelength separation and AWG for wavelength composition were communalized, and AWG for wavelength separation composition which AWG for wavelength separation and AWG for wavelength composition communalized and consisted of is formed on the substrate 2 like the optical ADM equipment 1 of the 1st operation gestalt. Moreover, the switch section 60 is arranged on the substrate 2.

[0048] The 1st channel waveguide section 110 contains the 1st one channel waveguide 111 for wavelength separation composition. The 1st slab waveguide section 120 for wavelength separation composition contains the 1st slab waveguide 121 for wavelength separation composition connected to the 1st channel waveguide 111 for wavelength separation composition. The array waveguide section 130 for wavelength separation composition contains two or more channel waveguides 1311-131M connected to the 1st slab waveguide 121 for wavelength separation composition. The 2nd slab waveguide section 140 for wavelength separation composition contains the 2nd slab waveguide 141 for wavelength separation composition connected to the channel waveguides 1311-131M. The 2nd channel waveguide section 150 for wavelength separation composition contains the 2nd two or more channel waveguides 1511-151N for wavelength separation composition connected to the 2nd slab waveguide 141 for wavelength separation composition.
[0049] In optical ADM equipment 101, AWG for wavelength separation composition will have the 1st channel waveguide 111 for wavelength separation composition, the 1st slab waveguide 121 for wavelength separation composition, the array waveguide section 130 for wavelength separation composition, the 2nd slab waveguide 141 for wavelength separation composition, and the 2nd channel waveguide 1511-151N for wavelength separation composition.
[0050] Below, it explains supposing the case where the optical ADM equipment 101 concerning a **** 2 operation gestalt functions as an optical branch circuit. That is, the signal light inputted into the 1st channel waveguide 111 for wavelength separation composition is separated spectrally, and it explains supposing the case where the signal light of each of that wavelength separated spectrally is outputted to channel waveguide [of N book / 2nd / for wavelength separation composition / 1511-151N] any they are.
[0051] The 1st channel waveguide 111 for wavelength separation composition has input edge 111a in the end face of a substrate 2, and has outgoing end 111b which outputs the signal light inputted into this input edge 111a in a junction location with the 1st slab waveguide 121 for wavelength separation composition.
[0052] The 1st slab waveguide 121 for wavelength separation composition makes the signal light inputted into the 1st slab waveguide 121 for wavelength separation composition from outgoing end 111b of the 1st channel waveguide 111 for wavelength separation composition input into the input edge of the array waveguide section 130 for wavelength separation composition joined to this 1st slab waveguide 121 for wavelength separation composition.
[0053] The array waveguide section 130 for wavelength separation composition has input edge 131a which inputs signal light from the 1st slab waveguide 121 for wavelength separation composition, and outgoing end 131b which outputs the signal light to the 2nd slab waveguide 141 for wavelength separation composition. each optical path lengths differ predetermined length deltaL every, and the channel waveguides 1311-131M of M book give phase contrast to the signal light which guides each.
[0054] The 2nd slab waveguide 141 for wavelength separation composition makes the signal light inputted into the 2nd slab waveguide 141 for wavelength separation composition from outgoing end 131b of the array waveguide section 130 for wavelength separation composition input into channel waveguide [which is joined to this 2nd slab waveguide 141 for wavelength separation composition / 2nd / for

wavelength separation composition / 1511-151N] input edge 151a.
[0055] Each outputs the signal light inputted into input edge 151a from the 2nd slab waveguide 141 for wavelength separation composition to outgoing end 151b in which it was prepared by the end face of a substrate 2 1511-151Ns of 2nd channel waveguide for wavelength separation composition.
[0056] moreover, the 1st optical circulator 181 by which optical ADM equipment 101 was connected to the 1st channel waveguide 111 for wavelength separation composition, and every -- it has the 2nd optical circulator 182 connected to channel waveguide [2nd / for wavelength separation composition / 1511-151N] outgoing end 151b. The 1st optical circulator 181 has 1st terminal 181a, 2nd terminal 181b connected to the 1st channel waveguide 111 for wavelength separation composition, and 3rd terminal 181c. This 1st optical circulator 181 outputs the lightwave signal inputted into 1st terminal 181a from the 2nd terminal 181b, and outputs the signal light inputted into 2nd terminal 181b from the 1st channel waveguide 111 for wavelength separation composition from the 3rd terminal 181c. The 2nd optical circulator 182 has 1st terminal 182a, 2nd terminal 182b connected to the 2nd corresponding channel waveguide 1511-151N for wavelength separation composition, and 3rd terminal 182c. The 2nd optical circulator 182 outputs the signal light inputted into 1st terminal 182a (ad) to channel waveguide [2nd / for wavelength separation composition / 1511-151N] outgoing end (input edge) 151b, and outputs signal light inputted into 2nd terminal 182b from channel waveguide [2nd / for wavelength separation composition / 1511-151N] outgoing end 151b from the 3rd terminal 182c (drop).
[0057] a substrate 2 -- between the 2nd slab waveguide 141 for wavelength separation composition, and the 2nd channel waveguide section 150 for wavelength separation composition -- every -- the slot 3 which extends in the direction in which the 2nd channel waveguide 1511-151N for wavelength separation composition was installed side by side is formed. Moreover, the movable mirror 61 of the 2nd channel waveguide 1511-151N for wavelength separation composition and the same number is arranged in the switch section 60 in the shape of an array. Each movable mirror 61 is constituted free [migration in the advance direction and the recession direction] to the slot 3 of the location corresponding to the optical path in the 2nd corresponding channel waveguide 1511-151N for wavelength separation composition.
[0058] When a predetermined electrical potential difference is impressed between the 1st electrode layer (not shown) and the 2nd electrode layer (not shown), the movable mirror 61 will be in the condition of having marched out to the slot 3 of the location corresponding to the optical path in the 2nd channel waveguide 1511-151N for wavelength separation composition. In the condition that the movable mirror 61 marched out to the slot 3 of the location corresponding to the optical path in the 2nd channel waveguide 1511-151N for wavelength separation composition, the movable mirror 61 reflects the signal light outputted from the 2nd slab waveguide 141 for wavelength separation composition, and this signal light is not inputted into the 2nd channel waveguide 1511-151N for wavelength separation composition.
[0059] When not impressing a predetermined electrical potential difference between the 1st electrode layer and the 2nd electrode layer, the movable mirror 61 will be in the condition of having left to the slot 3 of the location corresponding to the

optical path in the 2nd channel waveguide 1511-151N for wavelength separation composition. In the condition that the movable mirror 61 left to the slot 3 of the location corresponding to the optical path in the 2nd channel waveguide 1511-151N for wavelength separation composition The signal light outputted from the 2nd slab waveguide 141 for wavelength separation composition It passes along the space in a slot 3, and is inputted into the 2nd channel waveguide 1511-151N for wavelength separation composition, and it results in channel waveguide [2nd / for wavelength separation composition / 1511-151N] outgoing end 151b, and is inputted into the 2nd optical circulator 182. Moreover, the signal light outputted to channel waveguide [2nd / 1511-151N] outgoing end (input edge) 151b from the 2nd optical circulator 182 (ad) passes along the space in a slot 3, and is inputted into the 2nd slab waveguide 141 for wavelength separation composition.
[0060] Thus, with the optical ADM equipment 101 concerning a **** 2 operation gestalt, it becomes small about the area of a substrate 2 like the optical ADM equipment 1 of the 1st operation gestalt as compared with the conventional optical ADM equipment using a heat optical switch. Consequently, enlargement of optical ADM equipment 101 can be controlled.
[0061] Moreover, in the optical ADM equipment 101 of a configuration of that AWG for wavelength separation and AWG for wavelength composition were communalized, simple and the configuration which can be arranged in low cost are [the switch section 60] realizable. Moreover, the precision prescribe over the arrangement location of the movable mirror 61 is eased, attachment by the substrate 2 of the switch section 60 becomes easy, and productivity can be improved.
[0062] Furthermore, the switch section 60 has the movable mirror 61 which reflects signal light, and the reflection factor to the signal light of each wavelength separated spectrally serves as abbreviation regularity. Consequently, as shown in drawing 8 , the transparency band of optical ADM equipment 101 will have a flat property substantially, and can control that reflectivity changes to fluctuation of the wavelength of signal light.
[0063] (The 3rd operation gestalt) Next, based on drawing 9 , the optical ADM equipment concerning the 3rd operation gestalt of this invention is explained. Drawing 9 is the block diagram showing the optical ADM equipment concerning the 3rd operation gestalt.
[0064] The optical ADM equipment 201 concerning the 3rd operation gestalt is considered as the configuration between which the 2nd slab waveguide for wavelength separation and the 2nd slab waveguide for wavelength composition share the part in AWG for wavelength separation, and AWG for wavelength composition, and each AWG is formed on the substrate 2 like the optical ADM equipment 1,101 of the 1st operation gestalt and the 2nd operation gestalt. Moreover, the switch section 60 is arranged on the substrate 2.
[0065] The 2nd slab waveguide section 240 for wavelength separation composition contains the 2nd slab waveguide 241 for wavelength separation composition of a configuration of that the 2nd slab waveguide for wavelength separation connected to the array waveguide section 31 for wavelength separation and the 2nd slab waveguide for wavelength composition connected to the array waveguide section 32 for wavelength composition share the part.
[0066] In optical ADM equipment 201, AWG for wavelength separation will have the 1st channel waveguide 11 for wavelength separation, the 1st slab waveguide 21 for

wavelength separation, the array waveguide section 31 for wavelength separation, the 2nd slab waveguide 241 for wavelength separation composition, and the 2nd channel waveguide 1511-151N for wavelength separation composition. On the other hand, in optical ADM equipment 201, AWG for wavelength composition will have the 1st channel waveguide 12 for wavelength composition, the 1st slab waveguide 22 for wavelength composition, the array waveguide section 32 for wavelength composition, the 2nd slab waveguide 241 for wavelength separation composition, and the 2nd channel waveguide 1511-151N for wavelength separation composition.
[0067] The 2nd slab waveguide 241 for wavelength separation composition makes the signal light inputted into the 2nd slab waveguide 241 for wavelength separation composition from outgoing end 31b of the array waveguide section 31 for wavelength separation input into channel waveguide [which is joined to this 2nd slab waveguide 241 for wavelength separation composition / 2nd / for wavelength separation composition / 1511-151N] input edge 151a. Moreover, the 2nd slab waveguide 241 for wavelength separation composition makes the signal light inputted into the 2nd slab waveguide 241 for wavelength separation composition from channel waveguide [which is joined to this 2nd slab waveguide 241 for wavelength separation composition / 2nd / for wavelength separation composition / 1511-151N] input edge (outgoing end) 151a input into input edge 32a of the array waveguide section 32 for wavelength composition.
[0068] a substrate 2 -- the 2nd operation gestalt -- the same -- between the 2nd slab waveguide 241 for wavelength separation composition, and the 2nd channel waveguide 151 for wavelength separation composition -- every -- the slot 3 which extends in the direction in which the 2nd channel waveguide 1511-151N for wavelength separation composition was installed side by side is formed. Moreover, the movable mirror 61 of the 2nd channel waveguide 1511-151N for wavelength separation composition and the same number is arranged in the switch section 60 in the shape of an array. Each movable mirror 61 is constituted free [migration in the advance direction and the recession direction] to the slot of the location corresponding to the optical path in the 2nd corresponding channel waveguide 1511-151N for wavelength separation composition.
[0069] Thus, with the optical ADM equipment 201 concerning a **** 3 operation gestalt, the area of a substrate becomes small as compared with the conventional optical ADM equipment using a heat optical switch like the optical ADM equipment 1,101 of the 1st and 2nd operation gestalt. Consequently, enlargement of optical ADM equipment 201 can be controlled.
[0070] Moreover, in AWG for wavelength separation, and AWG for wavelength composition, simple and the configuration which can be arranged in low cost are [the switch section 60] realizable in the optical ADM equipment 201 of a configuration of that the 2nd slab waveguide for wavelength separation and the 2nd slab waveguide for wavelength composition share the part. Moreover, the precision prescribe over the arrangement location of the movable mirror 61 is eased, attachment by the substrate of the switch section 60 becomes easy, and productivity can be improved. Moreover, the transparency band of the optical ADM equipment 201 which has a flat property substantially can be realized like the 2nd operation gestalt, and it can control that reflectivity changes to fluctuation of the wavelength of signal light.
[0071] Furthermore, compared with the optical ADM equipment 101 of the 2nd

operation gestalt of a configuration of that AWG for wavelength separation and AWG for wavelength composition were communalized, it becomes unnecessary, and the 1st circulator 181 becomes possible [reducing the number of optical circulators], and low cost-ization of optical ADM equipment 201 of it is attained.

[0072] (The 4th operation gestalt) Next, based on drawing 10 and drawing 11 , the switch section contained in the optical ADM equipment concerning the 4th operation gestalt of this invention is explained. Drawing 10 is the top view showing the switch section, and drawing 11 is the side elevation showing the switch section. In addition, the optical ADM equipment concerning the 4th operation gestalt is different from the optical ADM equipment 1 applied to the 1st operation gestalt about the configuration of the switch section, it is the same as the optical ADM equipment 1 applied to the 1st operation gestalt about the configuration except the switch section, and detailed explanation is omitted.

[0073] The switch section 160 has the movable mirror 61, the 1st electrode layer 163 and the 2nd electrode layer 164, and an insulating layer 165, as shown also in drawing 12 and drawing 13 . The intersection (the 2nd channel waveguide 511-51N for wavelength separation or 2nd channel waveguide 521-52N for wavelength composition) and the movable mirror 61 of the same number are arranged in the switch section 160 in the shape of an array in the inside of a frame part 166, and each movable mirror 61 is installed in the shape of a straight line so that a slot 3 may be met. The movable mirror 61 is freely movable in the advance direction and the recession direction to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and the 2nd channel waveguide 521-52N for wavelength composition, and the switch section 160 is arranged on the substrate 2 so that the migration of each movable mirror 61 in the advance direction and the recession direction may be attained to the slot 3 of the location corresponding to each intersection. A frame part 166 consists for example, of polish recon.

[0074] The 1st electrode layer 163 consists of nickel, and the movable mirror 61 is formed in the edge by the side of the field of one of these. With the near edge in which the movable mirror 61 was formed, the 1st electrode layer 163 is formed to the frame part 166 so that it may be supported by the frame part 166 in the edge of the opposite side. The 2nd electrode layer 164 is formed in the location which counters one field of the 1st electrode layer 163 of a substrate 2 on both sides of an insulating layer 165. The 1st electrode layer 163 bends with the electrostatic attraction generated by impressing a predetermined electrical potential difference between the 1st electrode layer 163 and the 2nd electrode layer 164, and as shown in drawing 12 and drawing 13 , the movable mirror 61 is moved in the advance direction or the recession direction to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection. In this operation gestalt, width of face is set to about 200 micrometers, die length is set to about 1.5mm, and, as for the 1st electrode layer 163, thickness is set to about 2.0 micrometers. Moreover, thickness of the 2nd electrode layer 164 is set to about 50nm.

[0075] Moreover, while not impressing the predetermined electrical potential difference between the 1st electrode layer 163 and the 2nd electrode layer 164, it bends beforehand and the 1st electrode layer 163 is formed so that the movable mirror 61 may be in the condition of having left to each waveguides 511-51N of the

2nd channel waveguide section 50 for wavelength separation composition, and the optical path in 521-52N. This is not impressing the predetermined electrical potential difference between the 1st electrode layer 163 and the 2nd electrode layer 164. The condition that the movable mirror 61 left to the optical path in the 2nd channel waveguide 511-51N for wavelength separation and channel waveguide [2nd / for wavelength composition / 521-52N] intersection can be set up as an initial state. The power consumption for operating the switch section 160 (movable mirror 61) can be reduced. In addition, in this operation gestalt, it will be in the condition of having bent beforehand, by forming the 1st electrode layer 163 so that compressive stress may occur.

[0076] Next, the production process of the switch section 160 is explained based on drawing 14 . The switch section 160 is manufactured by using thin film technologies, such as a photolithography technique and an etching technique. In addition, in drawing 14 , although the example which forms one movable mirror 61 to the 1st one electrode layer 163 is shown, it can manufacture similarly about what arranged two or more movable mirrors 61 in the shape of an array.

[0077] First, as shown in drawing 14 (a), the metal pattern 172 corresponding to the 1st electrode layer 163 is formed with nickel on the Si substrate 71. The metal pattern 172 is formed at this time, controlling stress so that compressive stress occurs to the metal pattern 172 (1st electrode layer 163). The resist film 74 is applied on the metal pattern 172 after formation of the metal pattern 172.

[0078] Spreading of the resist film 74 fabricates the mold 75 of the part which is equivalent to the resist film 74 at the movable mirror 61 using a lithography technique etc., as shown in drawing 14 (b). Then, as shown in drawing 14 (c), nickel 76 is grown up as a metal which serves as the movable mirror 61 in the mold 75 formed in the resist film 74 with a metal plating technique. Finally, as shown in drawing 14 (d), the Si substrate 71 and the resist film 74 are removed using an etching technique. thus, the thing for which thin film technologies, such as a photolithography technique and an etching technique, are used -- the switch section 160 -- low cost -- and it can manufacture easily.

[0079] An electrical potential difference predetermined to between the 1st electrode layer 163 and the 2nd electrode layer 164 (in this operation gestalt) When about 20V is impressed, as shown in drawing 12 , an insulating layer bends with the electrostatic attraction generated between the 1st electrode layer 163 and the 2nd electrode layer 164. The movable mirror 61 will be in the condition that the movable mirror 61 marched out to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection. In the condition that the movable mirror 61 marched out to the optical path [in / in movable mirror 61 / the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide / 2nd / for wavelength composition / 521-52N / intersection] The movable mirror 61 reflects the signal light which was outputted from the 2nd slab waveguide 41 for wavelength separation, and has passed along the 2nd channel waveguide 511-51N for wavelength separation, and is made to input it into the 2nd corresponding channel waveguide 521-52N for wavelength composition.

[0080] When not impressing a predetermined electrical potential difference between the 1st electrode layer 163 and the 2nd electrode layer 164, as shown in drawing 13 , the movable mirror 61 will be in the condition of having left to the optical

path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection. In the condition that the movable mirror 61 left to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection The signal light which was outputted from the 2nd slab waveguide 41 for wavelength separation, and has passed along the 2nd channel waveguide 511-51N for wavelength separation will pass along the space in a slot 3, and will be resulted and dropped with channel waveguide [2nd / for wavelength separation / 511-51N] outgoing end 51b. Moreover, when the signal light by which the ad was carried out from channel waveguide [2nd / for wavelength composition / 521-52N] input edge 52a is inputted, the signal light by which the ad was carried out passes along the space in a slot 3, and results in channel waveguide [2nd / for wavelength composition / 521-52N] outgoing end 52b.

[0081] thus, with the ADM equipment concerning a **** 4 operation gestalt The 1st electrode layer 163 in which the movable mirror 61 and this movable mirror 61 are formed for the switch section 160, Have the 2nd electrode layer 164 and the 1st electrode layer 163 bends with the electrostatic attraction generated by impressing a predetermined electrical potential difference between the 1st electrode layer 163 and the 2nd electrode layer 164. By moving the movable mirror 61 in the advance direction or the recession direction to the optical path in the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide [2nd / for wavelength composition / 521-52N] intersection As compared with the conventional optical ADM equipment using a heat optical switch, the working speed of the switch section 160 can be made quick. Moreover, since the movable mirror 61 is formed in the 1st electrode layer 163 as compared with the thing of a configuration (configuration of the switch section 60 in the 1st operation gestalt) of forming the 1st electrode layer 63 in the field side of another side of an insulating layer 62 in which the movable mirror 61 is formed, it becomes possible to attain the process simplification and low-cost-izing at the time of manufacturing the switch section 160.

[0082] Moreover, the 1st electrode layer 163 can form very easily the 1st electrode layer 163 and movable mirror 61 in the switch section 160 by being formed with the same ingredient as the movable mirror 61. In addition, he is trying to constitute the 1st electrode layer 163 and movable mirror 61 from nickel in a **** 4 operation gestalt. By using nickel as the 1st electrode layer 163 and the ingredient of the movable mirror 61, the 1st electrode layer and movable mirror can be formed, using a metal plating [with a simple and process] technique with cheap equipment as a processing means. In addition, as long as an ingredient is an ingredient which has flexibility and conductivity, without being restricted to the nickel mentioned above, you may make it use metals, such as copper, gold, and silver, from a viewpoint that it is possible to use a metal plating technique, for example. Of course, you may make it constitute the 1st electrode layer 163 and movable mirror 61 from a different ingredient.

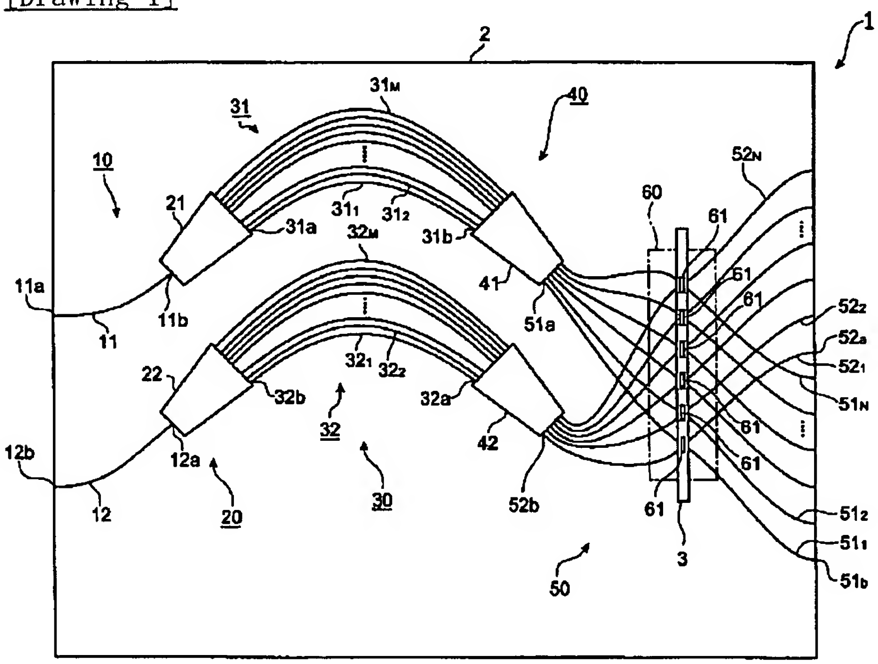
[0083] This invention is not limited to the operation gestalt mentioned above, and is not restricted to what mentioned above the number of the channel waveguides in the 1st channel waveguide section 10,110, the array waveguide section 30,130, or the 2nd channel waveguide section 50,150 grade for wavelength separation

composition etc.
[0084] Moreover, although optical ADM equipment 1,101,201 is constituted in the 1st - the 3rd operation gestalt so that a slot 3 may be formed in a substrate 2 Without being restricted to this for each [the 2nd channel waveguide 511-51N for wavelength separation, and channel waveguide / for wavelength composition / 521-52N / 2nd] intersection of every or every -- you may constitute so that a hole may be formed independently 1511-151Ns of every 2nd channel waveguide for wavelength separation composition.
[0085]
[Effect of the Invention] As mentioned above, as explained to the detail, according to this invention, the optical ADM equipment which can control enlargement of equipment can be offered.

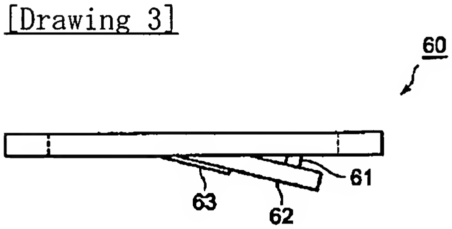
[Translation done.]

DRAWINGS

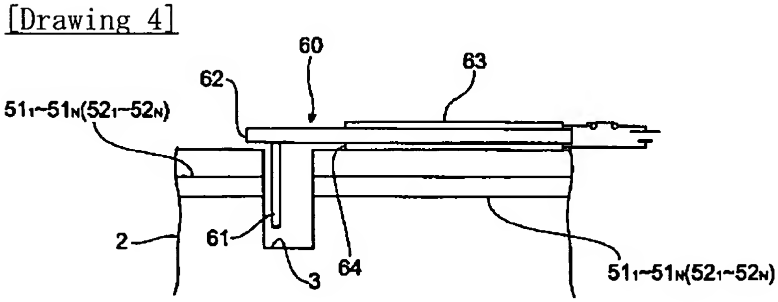
[Drawing 1]



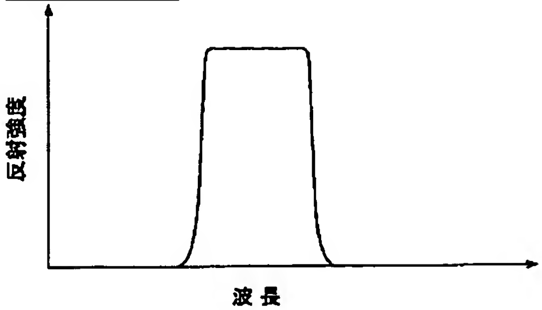
[Drawing 3]



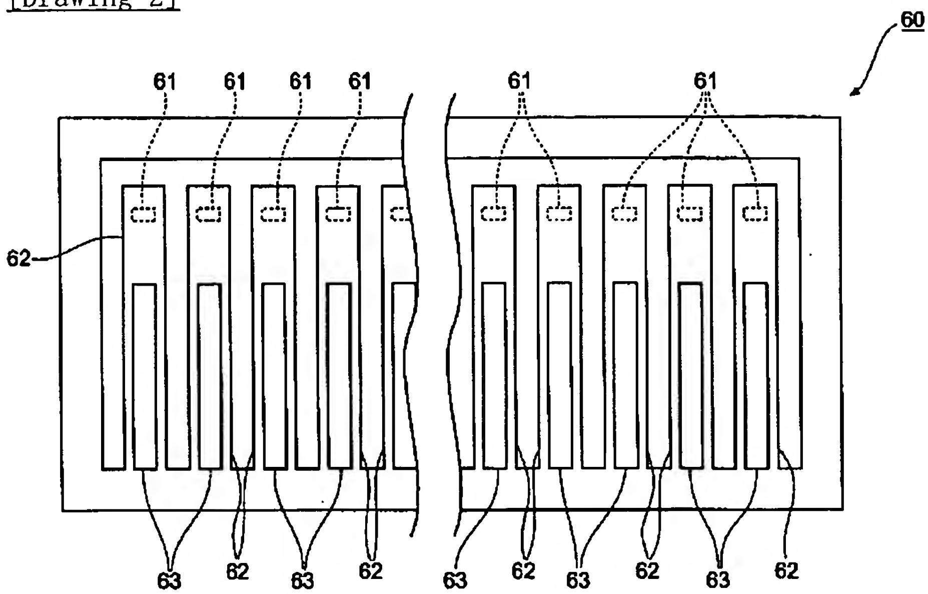
[Drawing 4]



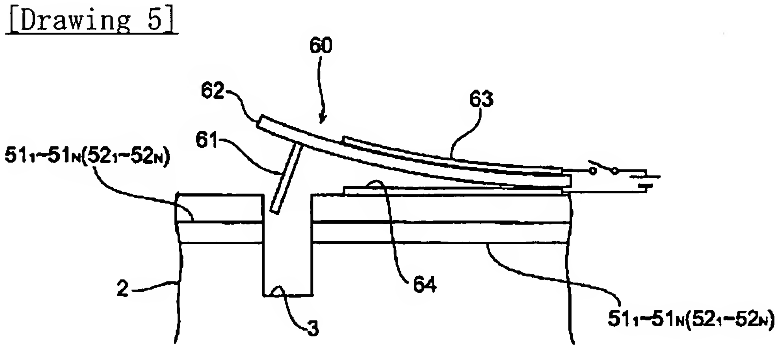
[Drawing 8]



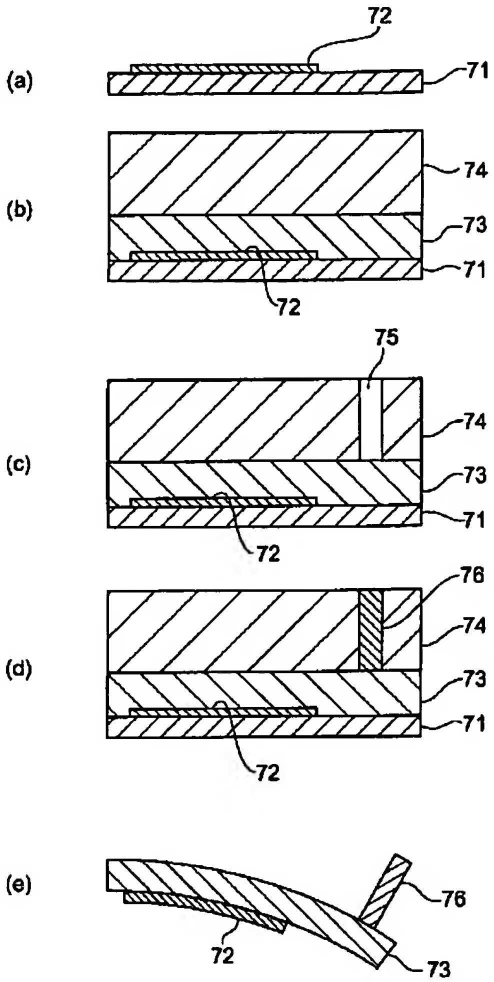
[Drawing 2]



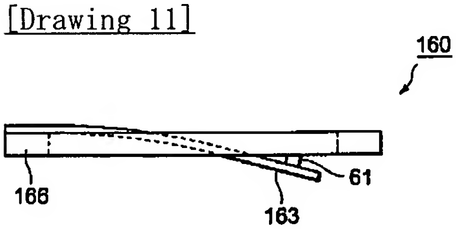
[Drawing 5]



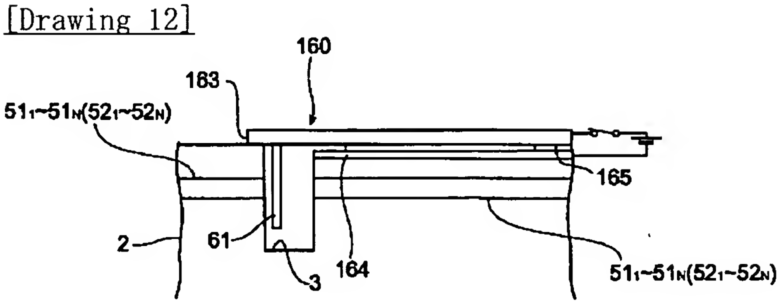
[Drawing 6]



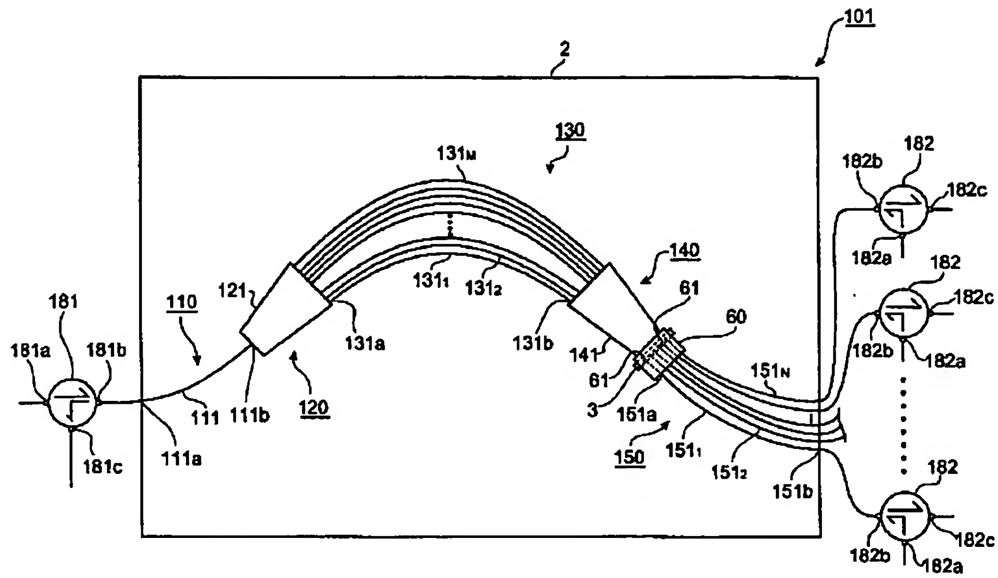
[Drawing 11]



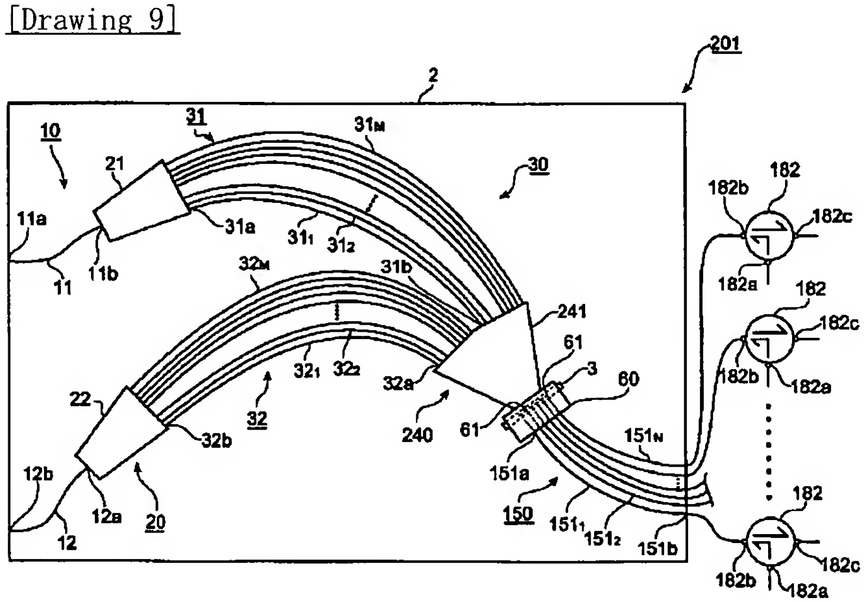
[Drawing 12]



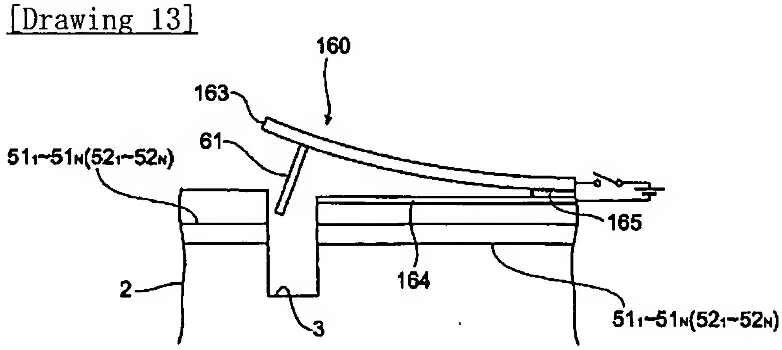
[Drawing 7]



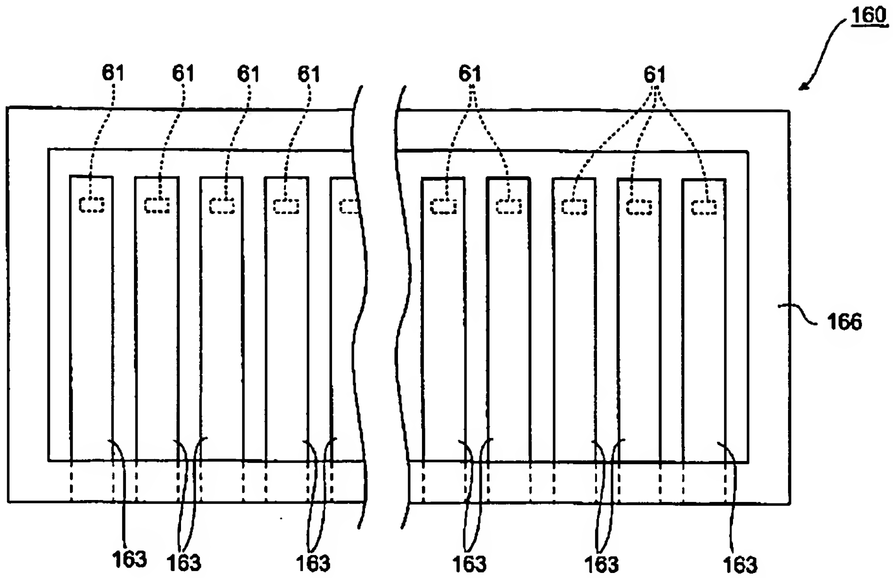
[Drawing 9]



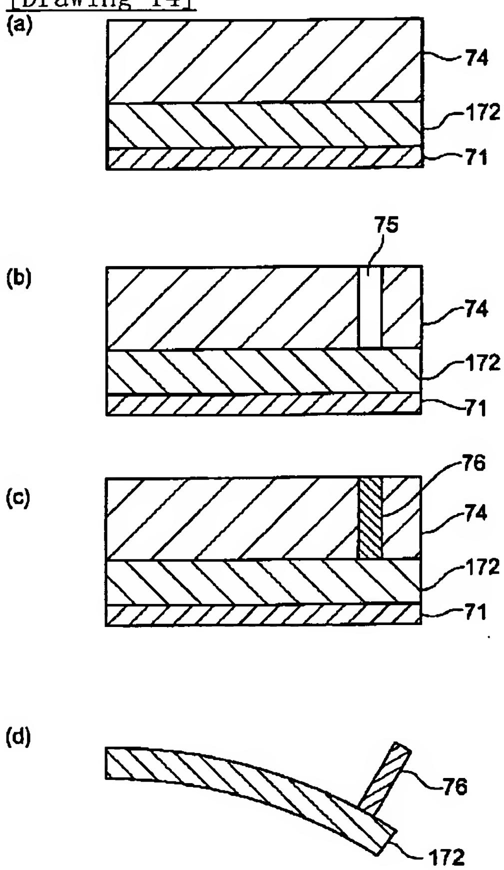
[Drawing 13]



[Drawing 10]



[Drawing 14]



[Translation done.]